

BY THE COMPTROLLER GENERAL

# Report To The Congress

OF THE UNITED STATES

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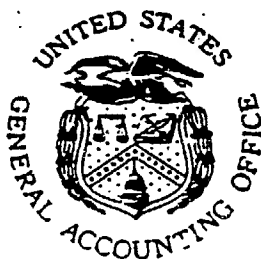
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## Need For Improving Mapping, Charting, And Geodesy Support Of The Strategic Ballistic Missile Submarine Force

"NATIONAL SECURITY INFORMATION"  
UNAUTHORIZED DISCLOSURE SUBJECT  
TO CRIMINAL SANCTIONS

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Pursuant to: Letter Dated July 19, 1984 from  
Principal Deputy Under Secretary  
of Defense for Research and  
Engineering

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COMPTROLLER GENERAL OF THE UNITED STATES

WASHINGTON, D.C. 20548

B-145099

To the President of the Senate and the  
Speaker of the House of Representatives

This report discusses the classified aspects of our review of the Nation's oceanographic assets. A draft of the report was reviewed by agency officials associated with the program. Their comments are incorporated as appropriate.

We made our review pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

We are sending copies of this report to the Director, Office of Management and Budget; the Secretary of Defense; and Members of Congress.

*James P. Stacks*  
Comptroller General  
of the United States

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COMPTROLLER GENERAL'S  
REPORT TO THE CONGRESS

NEED FOR IMPROVING MAPPING,  
CHARTING, AND GEODESY SUPPORT  
OF THE STRATEGIC BALLISTIC  
MISSILE SUBMARINE FORCE

D I G E S T

Strategic Ballistic Missile Submarines may not be as effectively deployed as possible to carry out their ~~(SECRET)~~ strategic deterrent mission unless there is an improvement in the Mapping, Charting, and Geodesy support ~~(SECRET)~~ provided by the Navy Ocean Survey Program.

As part of the Naval Oceanographic program, the Ocean Survey Program provides, in response to priority strategic defense requirements, the oceanographic collection, processing, and analysis of essential bathymetric, gravimetric and magnetic ~~(SECRET)~~ data to enhance the effectiveness, and operational flexibility of the--Polaris, Poseidon, Trident--strategic forces.

Data collected by the Ocean Survey Program fleet is used to provide Mapping, Charting, and Geodesy products for the navigational safety of the submarine forces, strategic weapons systems accuracy, secure positioning, and can be used to support sonar systems, and to increase the operational effectiveness of other oceanographic ~~(SECRET)~~ surveillance systems.

During a review of the nation's ocean vessel/survey fleet, GAO found that the Navy's oceanographic program is fragmented, uncoordinated, and often inefficient. For example, the Navy, because of budgetary constraints, leased six oceanographic vessels to foreign countries at no cost during the same timeframe that high priority strategic submarine data deficiencies ~~(SECRET)~~ were evolving.

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GAO believes that Ocean Survey Program deficiencies are due in large part to fragmented and decentralized resource management of the Navy's oceanographic assets, and GAO questions the ability of the U.S. Navy to continue to support ~~(SECRET)~~ strategic ballistic missile submarines through the Ocean Survey Program. While U.S. strategic submarine forces are being modernized through Trident submarine acquisitions, several of the Navy's unique ocean survey program vessels are now over 34 years old, and their operating condition was such that:

- Support of the strategic ballistic missile submarine force was curtailed due to the loss of over 590 Ocean Survey Program ship operating days during the past two years; ~~(SECRET)~~
- Mapping, charting, and geodesy products may not meet scheduled Trident ballistic missile submarine deployment dates and ~~(SECRET)~~ provide for more potentially effective Trident deployments;
- Strategic ballistic missile submarine operations may not be able to meet changing U.S. nuclear weapons deployment policy needs, because of the lack of adequate data to operate in areas that were not surveyed. ~~(SECRET)~~

In commenting on this report, the Department of Defense concurred that the age of Ocean Survey Program ships may contribute to the risk that data may not be provided in a timely manner to meet ~~(SECRET)~~ strategic submarine requirements, and while Defense is taking actions to improve this support, ~~(SECRET)~~ GAO believes that this problem is only part of the larger problem of having the naval oceanographic program separated in several Navy commands.

GAO believes that the Naval Oceanographic community has much to offer to the safer and more efficient accomplishment of the strategic deterrent mission. However, GAO noted that,

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despite the Ocean Survey Program relationship to high priority defense objectives, there has been a lack of resource emphasis of the potential contributions of (~~SECRET~~) Mapping, Charting, and Geodesy data necessary (~~SECRET~~) to both strategic ballistic missile submarine operational effectiveness, and to maintaining the overall U.S.-Soviet strategic deterrent balance.

#### RECOMMENDATIONS

GAO recommends that the Secretary of Defense evaluate the support (~~SECRET~~) provided by the Ocean Survey Program to strategic ballistic missile submarines, in order to preclude any deterioration in the U.S. ability to maintain and support strategic forces in a high state of readiness. (~~SECRET~~) Actions taken should include:

- reviewing all ballistic missile submarine mission requirements that may require Ocean Survey Program or other oceanographic support; (~~SECRET~~) and
- assessing the capability of the the Ocean Survey Program to support strategic ballistic missile submarine mission requirements in a timely fashion. (~~SECRET~~)

Further, GAO reaffirms the recommendation contained in its June 16, 1978, report to the Congress entitled "Need For Improving Management of U.S. Oceanographic Assets" (CED 78-125) which stated that:

- The Secretary of Defense direct the Secretary of the Navy to reorganize and consolidate management of all Navy oceanographic activities under the Oceanographer of the Navy or another designated single manager, and to assist and improve coordination with the designated civilian manager to maximize use of all U.S. oceanographic vessels.

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ABBREVIATIONS

BNC	- Bathymetric Navigational Chart
BOSS	- 
DMA	- Defense Mapping Agency
DOD	- Department of Defense
FBM	- Fleet Ballistic Missile
GAO	- General Accounting Office
JCS	- Joint Chiefs of Staff
MC&G	- Mapping, Charting, and Geodesy
NASA	- National Aeronautical and Space Administration
NAVSAT	- Navy Navigational Satellite
OSP	- Ocean Suvey Program
PBNZC	- Precise Bathymetric Navigational Zone Chart
SALT	- Strategic Arms Limitation Talks
SINS	- Ships Inertial Navigation System
SSBN	- Strategic Ballistic Missile Submarine

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CHAPTER 1

INTRODUCTION

On June 16, 1978, we issued to the Congress an unclassified report entitled "Need for Improving Management of U.S. Oceanographic Assets." (CED 78-125) This report pointed out that even though the Oceanographer of the Navy was designated as the central manager for all Navy oceanographic vessels and resources, the Navy's oceanographic program was fragmented and uncoordinated. As a result, we found there is inefficient and uncoordinated program and resource management.

In this report, we address the classified aspects of our findings, and describe the serious impact of the Navy's oceanographic management problems on its highest priority strategic support program.

The principal U.S. policy objective of the Department of Defense (DOD) policy guidance for the existence of U.S. nuclear weapons is strategic deterrence. To the extent that deterrence should fail, the major objectives are to assure a U.S. position of power and influence and to limit any conflict through control of enemy escalation, which includes:

- [REDACTED]
  - attempting to limit the level and scope of violence; and
  - [REDACTED]
- (SECRET)

Defense strategists consider secure second-strike systems, such as submarines, the most viable and effective means of deterring an opponent's preemptive attack. This consideration is based on the belief that the strategic nuclear submarines provide a covert mobile launching base.

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with minimum vulnerability to enemy detection and countermeasures, and that an actual strike against a submarine force would have to be directed against the entire force more or less simultaneously to eliminate the deterrence factor. Accordingly, DOD, in addition to maintaining land based strategic missiles and aircraft, deploys 41 nuclear powered Polaris/Poseidon Strategic Ballistic Missile Submarines (SSBNs) and is currently continuing development and procurement of an advanced Trident missile and submarine to eventually replace the Polaris submarine and update the Poseidon force.

### U.S. NUCLEAR WEAPONS STRATEGY

In time of war, should escalation become uncontrollable, the U.S. objective is to maximize the resultant political, economic, and military power of the United States relative to an enemy in a post-war period, in order to preclude enemy political domination. This would be accomplished by:

- targeting concepts that would ensure destruction of the enemy's critical political, economic, and military resources which would preclude them from recovering as a post-war major power;
- limiting the damage to the U.S. and its allies through counterforce operations; and
- maintaining a strategic force, in reserve, such as SSBNs, for protection of the United States and coercion of the enemy during and after a war.

Since the full range of political-military conditions cannot be anticipated prior to a conflict, U.S. nuclear employment plans are designed to allow for flexible adaptation as events would unfold prior to a war, and as hedges against unforeseen developments. This is accomplished by pre-planning nuclear weapons employment options, and selecting targets to the extent that they would enhance the flexibility, efficiency, and effectiveness of the forces or weapons systems utilized.

In this regard, the Naval oceanographic program, under the direction of the Oceanographer of the Navy, carries

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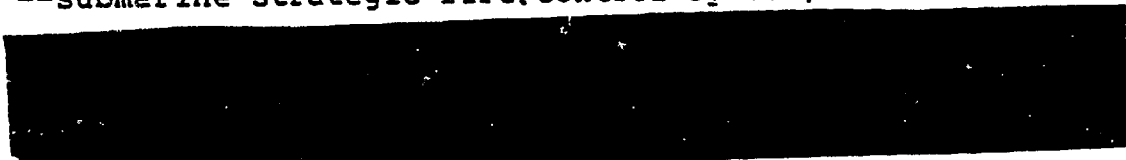
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on a broad spectrum of oceanographic and hydrographic survey operations that include strategic priority Mapping, Charting and Geodesy (MC&G) support of the SSBN forces--Polaris, Poseidon, Trident--and anti-submarine warfare programs.

#### RELATIONSHIP OF MC&G DATA TO WEAPONS SYSTEM CHARACTERISTICS

U.S. SSBNs are all weather weapons systems capable of delivering ballistic missiles to targets within a specified range. The missile system, as depicted in Appendix I, is housed aboard a strategic nuclear submarine which provides a mobile launching base with minimum vulnerability to enemy detection and anti-submarine countermeasures.

However, because of fire control and navigation problems there are certain geophysical factors that require precise bathymetric and gravity data updates (~~SECRET~~) to enable the SSBN to operate critical weapons systems components such as the:

- submarine inertial navigation system,
  - submarine strategic fire control system, and
- 

#### Fire Control and Inertial Navigation Problems

Navigation is defined as the art or science of conducting a vehicle from one position on the earth to another position. The primary problems of submarine navigation are

- how to identify position while submerged,
- how to determine the direction necessary to proceed from one position to another,
- how to measure the progress made while advancing toward the desired position, and
- how to maintain the accuracy of the SSBN ballistic missiles, while operating in the deep ocean.

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The SSBN navigation subsystem performs the task of submarine navigation.

[REDACTED] while on patrol.

The heart of the navigational subsystem on the SSBN is known as the Ship Inertial Navigation System (SINS). The SINS continuously supplies accurate ship velocity, attitude, and position output data to the fire control subsystem and the missile via the central navigational computer. This data is gathered by the SINS inertial sensors measuring the forces of gravity and the motion of the ship as it travels through the oceans (~~SECRET~~) and would be used by the fire control system to accurately fire the ballistic missiles on selected targets at any given time. Accordingly, effective deployment of the strategic submarine weapons system depends upon the ability of the SINS to provide the fire control subsystem with accurate positions to establish the location of the SSBN in relationship to its target.

#### SINS Errors and Vertical Deflections

Due to inherent imperfections in the SINS inertial sensors, the SINS develops errors that increase with the time the SSBN spends without SINS update during deployment, and after an extended period on patrol, the SINS data may no longer be sufficiently accurate, if left uncorrected or uncompensated for fire control purposes and consequently degrade the potential accuracy of the ballistic missiles.

The SINS calculations on the SSBN are performed in respect to the reference of a perfect ellipsoid because of its geometric approximation to the shape of the earth. But, due to variations in the earth's gravity field, an error called vertical deflection is introduced in the calculations. Vertical deflection, as depicted in Appendix II, is the difference (angle) between true vertical as measured from an ellipsoid and the real local vertical as measured by the direction of the gravitational pull at a particular location of the SSBN. (~~SECRET~~) As the ship travels through the oceans, the SINS tends to align with the local vertical and, as depicted in Appendix III, various geoid information

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must be included in the calculations of the missile trajectories to maintain the accuracy of the weapons system.

Therefore, the SINS must be supplemented with the submarine's position and gravity (~~SECRET~~) data from other navigational aids so that the SINS errors may be corrected.  
The Ocean Survey Program supplies the SSBN forces the necessary data to compensate the SINS for the effects of gravity or vertical deflection. (See Appendix IV).

#### OSP PROVIDES VITAL SUPPORT

OSP objectives are to provide for SSBN force needs in secure positioning and weapons system accuracy. As depicted in Appendix IV, bathymetric and geodetic data is collected worldwide in the deep ocean to provide for the safe navigation of the strategic submarine forces and to maintain the SSBNs ballistic missile accuracies while on patrol, as well as increasing the operational effectiveness of other ocean surveillance systems. Data collected by OSP oceanographic operations is provided to the Defense Mapping Agency (DMA) for publication and distribution to the submarine fleets in the form of OSP products. A portion of the data collected by OSP is sanitized and made available for dissemination by DMA to civilian maritime vessels to provide for safe surface navigation.

#### OSP Products

OSP operations collect, process and analyze the essential bathymetric, gravimetric and magnetic data to support the operational effectiveness of the SSBN strategic forces. The geophysical information derived from OSP survey activities result in processed:

--bathymetric data, [REDACTED]

--gravity data, [REDACTED]

and [REDACTED]

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--magnetic data, [REDACTED]

From the collected geophysical data, OSP products are produced to provide the SSBNs with:

--Bathymetric navigational charts (BNCs) [REDACTED]

--Precise bathymetric navigation zone charts (PBNZCs) [REDACTED]

--Vertical deflection [REDACTED]

required for deflection computations necessary for correction of the submarine's inertial navigational system; and

--Magnetic anomaly detection (MAD) operational effectiveness charts [REDACTED]

### Correcting SINS Errors

Because the characteristics of SINS errors are known, this knowledge, coupled with OSP products and a navigational position fix, is utilized to correct the errors. The process of entering corrections into the SINS to enable the SSBN to maintain system accuracy and navigate safely is referred to as SINS reset.

Resetting the SINS requires that the submarine's position data be derived from a navigational fix to complete the reset process. Currently, SSBN navigational fixes are accomplished by using:

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- land based LORAN-C transmitting stations,
- Navy navigational satellite (NAVSAT) transmissions,  
and

and effective means in relationship to the mission and security of the SSBNs. This rationale is based on the fact that to complete the navigational fix:

- LORAN-C requires the submarine to place an antenna on the ocean surface to receive LORAN-C signal transmissions from stations which are limited in geographical coverage, expensive to extend, and vulnerable to hostile action;
- NAVSAT requires that the submarines operate at periscope depth, and place an exposed antenna above the ocean surface to receive satellite navigational signals, and is dependent upon U.S. satellite survivability while;


Also, the time requirements for SINS reset and necessary navigational fixes vary, depending on the SSBN class. For example, the:

- Polaris SSBNs, the first U.S. strategic submarine class, require that the SINS reset process be accomplished every 8 to 15 hours of ship operation;  
(~~SECRET~~)
- Poseidon SSBNs require a SINS reset at intervals of every \_\_\_\_\_ of operation; and

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--Trident SSBNs, because of inertial system improvements,  
will permit reset at intervals of approximately every  


Accordingly, determination and elimination of inherent SINS errors are a major operational consideration in the navigational subsystem and fire control system of SSBNs because the ballistic missile's accuracy is dependent on accurate navigational data and, until inertial systems technology reaches the state where SINS reset procedures can be eliminated, SSBNs will continue to rely upon OSP data as an important means to correct SINS errors. Additionally, while the time intervals for SINS reset requirements will be lengthened with Trident deployments, the use of OSP produced PBNZCs for covert bottom contour position fixes will continue to prove important in avoiding potential advanced anti-submarine detection techniques. ~~(SECRET)~~

#### OSP Data Sources

 collection sources of OSP data exist for SSBN support. These include:

--Two specially equipped survey ships which collect bathymetry, magnetic, and gravity data;



Specific appropriations allocated to the OSP deep ocean bathymetric surveys effort for fiscal years 1974 through 1977 are as follows:

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Fiscal Year

<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
----- (millions) -----			
\$14.2	\$16.8	\$19.9	<u>a</u> /\$16.9

a/does not include \$13.8 million for conversion of USNS HESS.

OSP Survey Ship Operations

The following table depicts the OSP fleet.

OSP Oceanographic Vessels

<u>Ship</u>	<u>Year built</u>	<u>Vessel length</u> -feet-	<u>FY79 cost per day</u>
USNS Bowditch	1944	454	\$18,305
USNS Dutton	1944	454	\$18,135
USNS Michelson <u>1</u> /	1944	454	--
USNS Wyman <u>2</u> /	1971	286	\$8,175
USNS Hess <u>3</u> /	1965	564	\$17,745

1/Decommissioned April 15, 1975.

2/Special purpose ship used for developing prototype system for advancing deep ocean precise bottom surveys and collecting gravity data, but not yet fully operational because of survey array problems (~~SECRET~~)

3/Converted for OSP use at a cost of \$13.8 million. The USNS Hess began OSP operations during FY78.

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## SCOPE OF REVIEW

Our review was performed primarily at the Defense Mapping Agency Headquarters, Offices of Oceanographer of the Navy, and the Naval Oceanographic Office. We also visited the National Security Council, Department of the Navy, Central Intelligence Agency, Naval Intelligence Command, National Aeronautics and Space Agency, and National Oceanic and Atmospheric Administration.

The information presented herein was obtained by reviewing plans, reports, correspondence, and other documents and by discussions with various officials and military officers.



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## CHAPTER 2

### OSP MC&G DATA NOT SUFFICIENT

#### TO SUPPORT SSBN MISSION REQUIREMENTS

Despite significant technological improvements in submarines, SSBN's inertial navigation and fire control systems are still dependent on oceanographic MC&G data and OSP products to support their effective deployments and operations. While the U.S. strategic submarine forces are being modernized through Trident acquisitions, we question the ability of the Navy's MC&G program to continue to support ~~(SECRET)~~ potentially more effective SSBN operations.

Only a small portion of the earth's oceans have been OSP surveyed for submarine operations, ~~(SECRET)~~ despite greater increases in ballistic missile ranges, larger operating areas, and the potential U.S. requirement for increased SSBN deployment and area coverage. As of July 1977, we were informed by Navy officials that in potential SSBN operating areas only the Mediterranean Sea, less than half of the Atlantic and approximately 5 percent of the Pacific Ocean requirements have been OSP surveyed for SSBN operations. ~~(SECRET)~~

Significantly, while the defense modernization programs for strategic weapons systems have resulted in notable advances in submarine and ballistic missile technology, the MC&G support for the Fleet Ballistic Missile (FBM) program has not kept pace and will require over 2.8 million ~~(SECRET)~~ track miles of OSP work extending into the year 1993, ~~(SECRET)~~ assuming the current OSP fleet of three vessels is maintained.

Depending on the outcome of Strategic Arms Limitation Talks (SALT), we were informed by Defense Mapping Agency officials that other potential operating areas may require over 5 million ~~(SECRET)~~ track miles of OSP survey effort extending into the year 2020 ~~(SECRET)~~ and could be needed to more effectively deploy SSBN forces.

Beginning in 1959, three OSP vessels, the USNS Bowditch, USNS Dutton, and the USNS Michelson, equipped with unique survey arrays, ~~(SECRET)~~ began survey operations in support of the Polaris FBM program. Since that time, changes in

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the global extent of U.S. strategic deterrent operations has created greater geographical demand for OSP products to support FBM operations. This increased demand is the result of the deployment of the Poseidon forces and the current development and production of the advanced Trident weapons systems. The Poseidon/Trident SSBNs and the weapons they deploy will have greater missile ranges as depicted in the following table, and, consequently, will be able to operate in larger ocean areas that were not previously surveyed for submarine deployment and operations. ~~(SECRET)~~

<u>SSBN</u>	<u>Type of missile</u>	<u>Maximum missile range to targets</u> (nautical miles)	<u>Area deployed</u>
Trident	C-4		Atlantic & Pacific
Poseidon (31 deployed)	2/C-3	2500	Atlantic
Polaris (10 deployed)	A-3	2500	Pacific

1/Range depends on total missile payload. ~~(SECRET)~~

2/Some will be backfitted with Trident I(C-4) missiles.

However, the three original survey vessels equipped to support priority strategic deterrent SSBN systems are now over 34 years old and their operating condition was such that

- The USNS Michelson was decommissioned during April 1975 and, despite the forthcoming Trident MC&G requirements, three years will have elapsed before its replacement, the USNS Hess, becomes fully operational;
- almost \$4 million was expended to accomplish overhauls of the USNS Bowditch and Dutton in an attempt to continue their operational usefulness, despite their ages;
- less than one year following overhaul, the USNS Dutton experienced failure of major strength members indicated by cracks found during ship hull inspections;

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--because of the degrading conditions of the two OSP vessels, a total of 592 ship operating days were lost during the period of June 1975 to June 1977; and due to these problems,

--Trident OSP products may not be produced in time for effective Trident SSBN deployments. ~~(SECRET)~~

While the addition of the USNS Hess will provide additional OSP vessel support, we believe that the dependability and reliability factors associated with the USNS Bowditch and Dutton raise serious doubts as to their long-time availability as Ocean Survey Program vessels. According to the Joint Strategic Capabilities Plan and other Defense documents we reviewed, continued dependence on these vessels has and could continue to jeopardize the collection of vital data to support SSBN deployments and, therefore, impair the U.S. ability to maintain the adequacy of the U.S. strategic deterrence mission, particularly if the mission posture would necessitate changes in submarine deployment areas and targets. ~~(SECRET)~~

#### OCEANOGRAPHIC SATELLITE OPERATIONS MAY HELP

Because knowledge of the effects of vertical deflection is critical to the accurate and reliable operation of the SSBN weapons system, mathematical techniques for improving measurements of the earth's gravity field were developed by the Naval Oceanographic Office. A simplified procedure was created to combine satellite derived altimetry measurements of geoid undulations with ship-collected detailed surface gravity measurements.

This technology represents a highly efficient procedure

[REDACTED]

Currently, the DOD utilizes the GEOS-3 experimental oceanographic satellite

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SEASAT-A IMPROVEMENTS IN  
SATELLITE DATA COLLECTION

Since the GEOS-3 launching, satellite research applications have led to further development of improved ocean sensors, and NASA, in cooperation with DOD and NOAA, is tentatively scheduled to launch SEASAT-A during June 1978. SEASAT-A is an ocean dynamics satellite that will carry five sensors to measure various key features of the oceans. Included in the instruments package is a radar altimeter that promises to derive more accurate geoid measurements and detection of sea mounts.

Coupled with the new technique for combining OSP collected gravity data, SEASAT-A will mean significant economies and efficiency in OSP program efforts to support the SSBN forces, because it will collect data from 95 percent of the earth's oceans. However, because

there will be a continuing need for vessel collection of OSP data.

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### CHAPTER 3

## CONCLUSIONS AND RECOMMENDATIONS

### CONCLUSIONS

Despite the fact that OSP supports the Navy's highest priority defense objectives, there has been a lack of resource emphasis of the potential contributions that Mapping, Charting, and Geodesy data can make to improving the operational effectiveness and security of SSBNs, and to the overall credibility of the U.S. strategic deterrent posture.

We believe that the OSP support deficiencies found during our review are a result of having a fragmented and decentralized naval oceanographic program.

In 1975, the Secretary of the Navy issued a directive to consolidate the Navy's oceanographic program resources under a single manager to improve its effectiveness. This directive, however, has never been fully implemented and allocation of Naval oceanographic resources remain separated throughout several Navy commands. As a result, we find that resources are still allocated for low priority programs at the same time resources are needed to maintain strategic high priority OSP support of SSBN forces. We believe this fragmented and decentralized use of the Navy's oceanographic resources has created a lack of overall management control and that all naval oceanographic functions should be consolidated under a single manager.

### DOD COMMENTS AND OUR EVALUATION

In response to our request for DOD to review and comment on this report, the Under Secretary of Defense for Research and Engineering concurred in our assessment that the age of OSP ships may contribute to the risk that MC&G data may not be provided in a timely manner to meet SSBN operational requirements. (~~SECRET~~) (See Appendix V).

He further stated that steps were being taken to provide an alternative means for MC&G data collection by activating newer ships with more dependable operational characteristics, intensifying efforts for backup survey capability and improving OSP management procedures to provide early indication of production schedule problems. (~~SECRET~~)

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We agree that these actions will help in preventing future SSBN force support problems. However, we were informed by Navy officials that OSP survey backup vessels will not have the same unique survey capability as the current OSP ships because there are no other ships in existence with that unique capability, (~~SECRET~~) and that no plans exist for replacing the two older OSP vessels.

In this regard subsequent to DOD's February 8, comments (see p. 23) which stated that OSP operations were now on schedule, we were informed by Navy officials that the USNS Dutton, in addition to having a cracked sonar dome, had sustained potentially serious major hull damage to the extent that the ship was abandoned during dry dock procedures for safety reasons, and that during June, 1978, the Bowditch had encountered major boiler problems. (~~SECRET~~) Consequently, these same officials stated that continued reliance on these ships could seriously jeopardize SSBN support, and that as of June 22, 1978, OSP was not on schedule.

(SECRET)

We believe that the new methods for combining SEASAT-A gravity data with ship derived gravity data will help erase one data deficiency. (~~SECRET~~) But, because there are no other alternative technologies, and since satellites cannot collect bathymetry or short-wave length gravity the Navy will continue to have a long term need for ship survey capability that could become a serious problem if additional SSBN operational areas are necessary (~~SECRET~~) to continue to maintain a U.S.-Soviet balance in strategic nuclear deterrence.

We recognize that OSP support should be provided as economically and efficiently as possible, but we found that the OSP deficiencies (~~SECRET~~) are due in large part to fragmented and decentralized resource management of the Navy's oceanographic assets. For example, we pointed out in our June 16, 1978, report that because of budgetary constraints, from 1970-76 Navy officials leased eight ocean research vessels to six foreign countries, one Federal agency and one U.S. university rather than place capable vessels in mothballs. These ships and their recipients are shown below.

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<u>Ship</u>	<u>Recipient</u>
Gillis (T-AGOR-4)	University of Miami
Davis (T-AGOR-5)	New Zealand
Eltanin (T-AGOR-8)	Argentina
Keathley (T-AGS-35)	Taiwan
Kellar (T-AGS-25)	Portugal
Sands (T-AGOR-6)	Brazil
Lee (T-AGS-31)	USGS
Gibbs (T-AGOR-1)	Greece

While all of these vessels were not capable of performing OSP related tasks, we believe that a single manager could have planned for long range programming of oceanographic resources on a priority basis and avoided giving up resources at a time when high priority SSBN data deficiencies were evolving. (~~SECRET~~)

#### RECOMMENDATIONS

We recommend that the Secretary of Defense evaluate the support provided by the Ocean Survey Program to strategic ballistic missile submarines in order to preclude any deterioration in the U.S. ability to maintain and support strategic defense forces in a high state of readiness. Actions taken should include:

--reviewing all SSBN mission requirements that may require OSP or other oceanographic support; (~~SECRET~~)  
and

--assessing the capability of the Ocean Survey Program to support SSBN mission requirements in a timely fashion. (~~SECRET~~)

Further, we reaffirm the recommendation contained in our June 16, 1978, report to the Congress entitled "Need for Improving Management of U.S. Oceanographic Assets" (CED-78-125) which stated that:

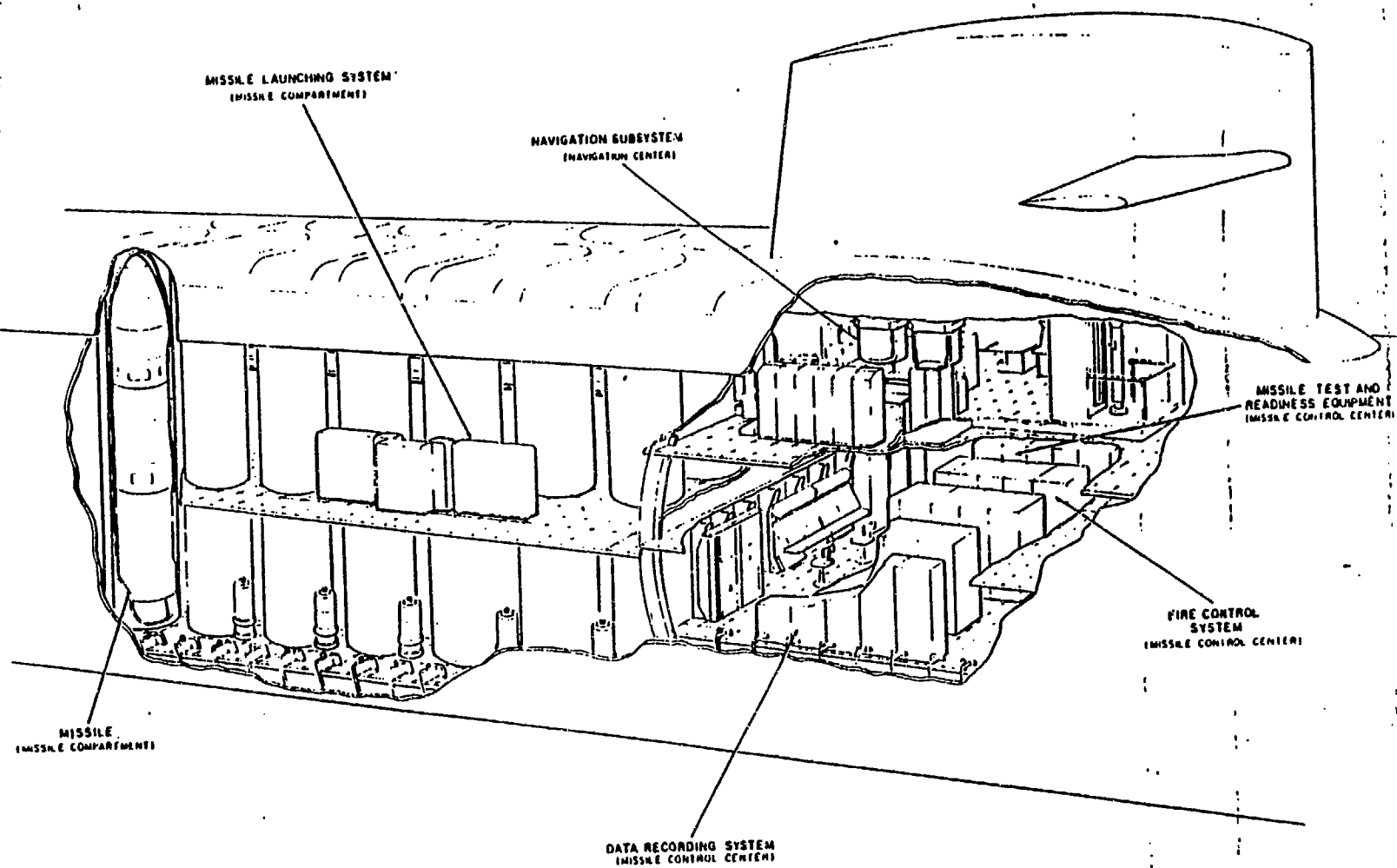
17  
~~SECRET~~

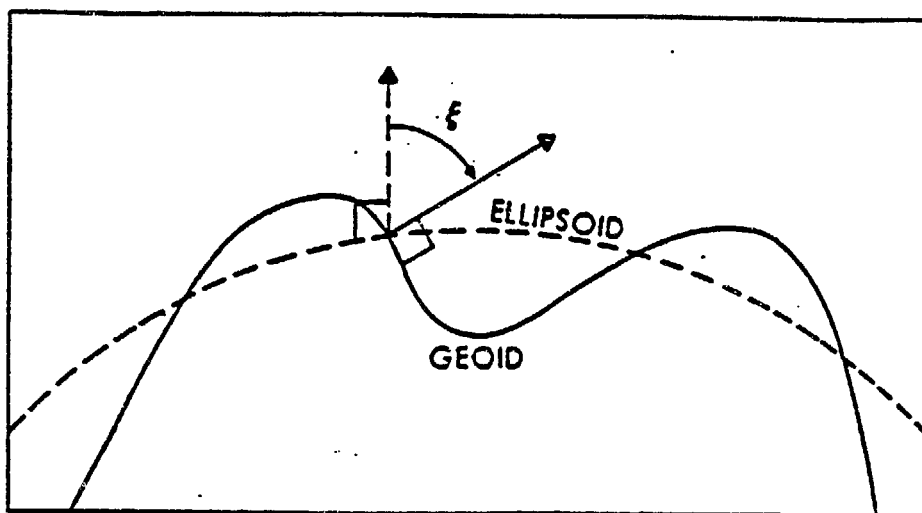


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--The Secretary of Defense direct the Secretary of the Navy to reorganize and consolidate management of all Navy oceanographic activities under the Oceanographer of the Navy or another designated single manager, and to assist and improve coordination with the designated civilian manager to maximize use of all U.S. oceanographic vessels.

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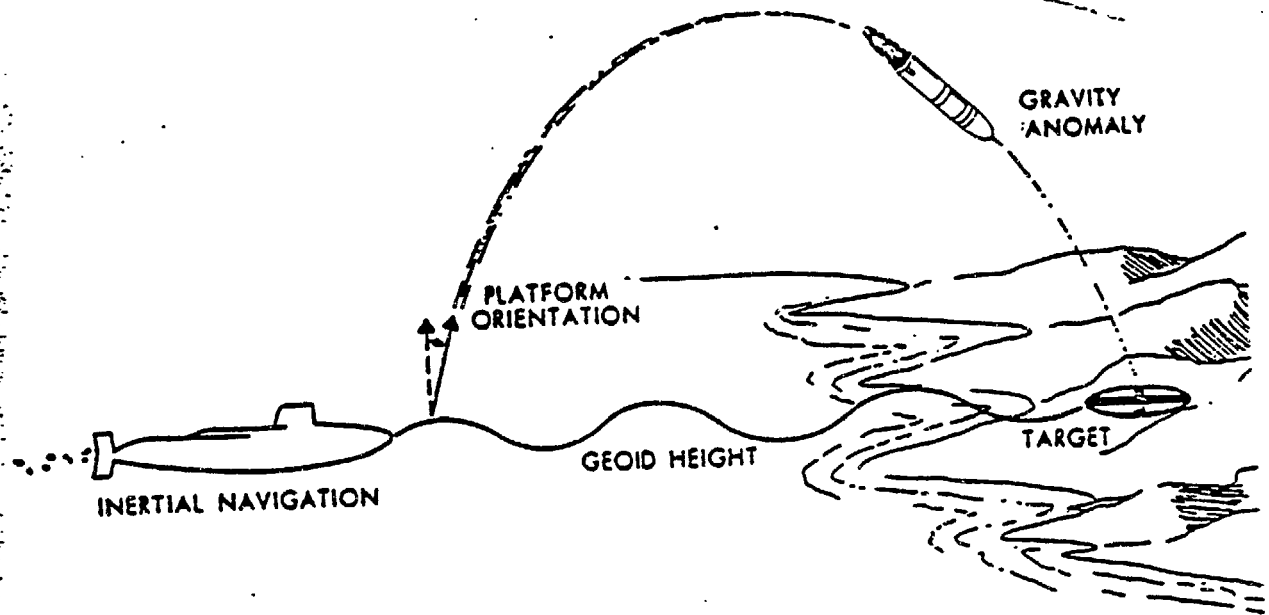
19  
SECRET



The difference in direction between the normal to the geoid and the normal to the ellipsoid is the deflection of the vertical. Leveling processes or inertial navigation equipment align missile guidance platforms along the normal to the geoid. The missile will miss the target if corrections are not made for the deflection of the vertical.

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--Geoid heights to determine missile launch altitude

--Gravity anomalies to determine disturbances in missile flight  
due to earth's gravity field.

--Deflections of the vertical and their effects on

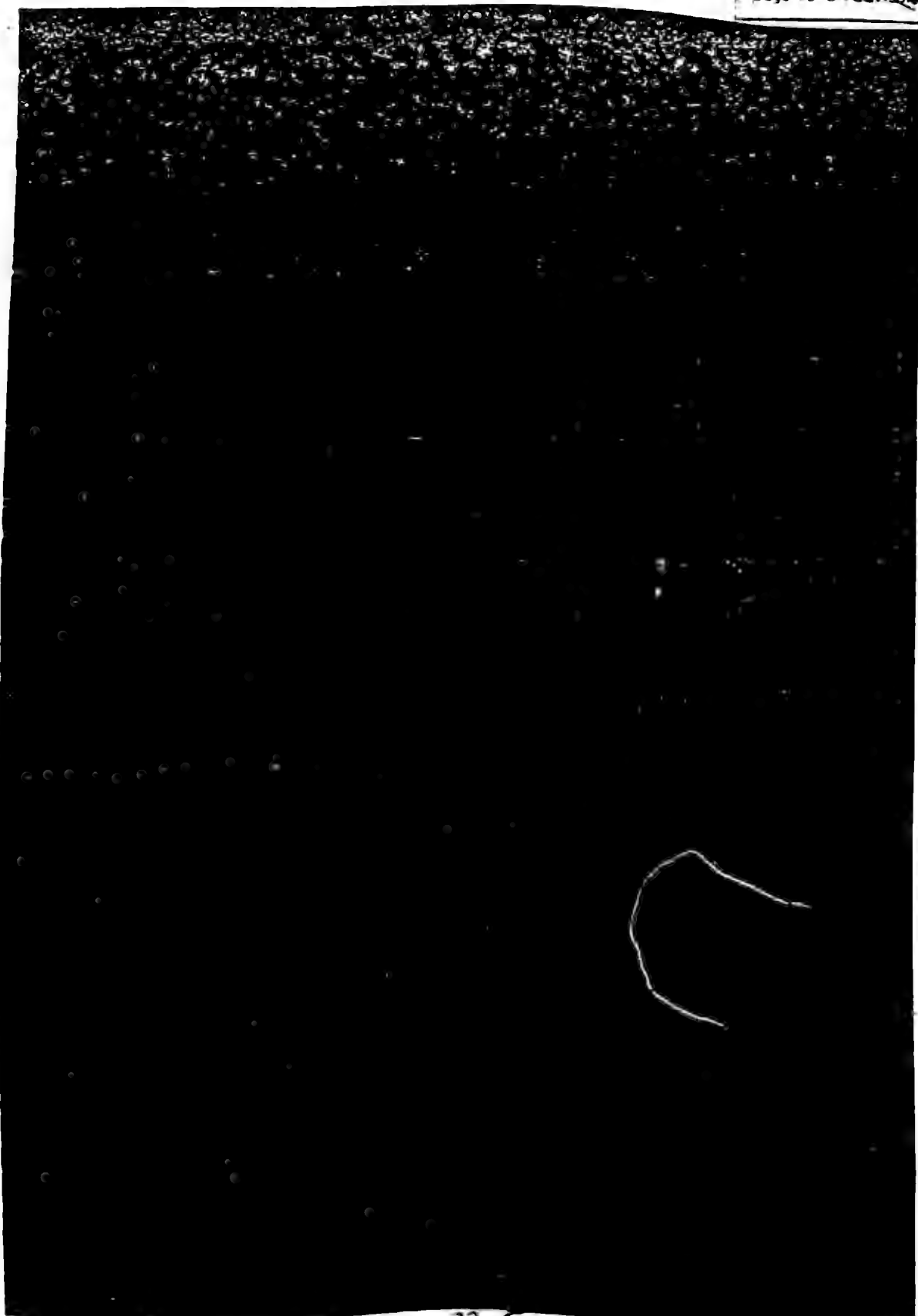
--missile platform erection determined by inertial  
navigation.

--ship's position and velocity determined by inertial  
navigation.

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22  
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~~SECRET~~RESEARCH AND  
ENGINEERINGTHE UNDER SECRETARY OF DEFENSE  
WASHINGTON, D.C. 20301

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8 FEB 1978

Mr. R. W. Gutman  
Procurement and Systems Acquisition Division  
United States General Accounting Office  
Washington, D. C. 20548

Dear Mr. Gutman:

(U) This is in response to your letter to the Secretary of Defense dated 3 November 1977 requesting review and comments concerning your draft report, "Need for Improving Mapping, Charting and Geodesy Support of the Strategic Ballistic Missile Submarine Forces." (GAO Code 14201, GAO Case #4753)

~~(S)~~ The main thrust of the report is that the Strategic Ballistic Missile Submarines may not be deployed as effectively as possible to carry out their strategic mission unless there is an improvement in the Mapping, Charting and Geodesy (MC&G) support provided by the Navy Ocean Survey Program (OSP). The report states that there has been a lack of emphasis and an inadequate appreciation for the potential contribution MC&G can make to strategic force readiness. The Department of Defense concurs in the assessment that the age of OSP ships may contribute to the risk that MC&G data may not be provided in a timely manner to meet operational requirements. This risk is recognized and the Department of Defense is taking steps to provide the means for alternative MC&G data collection. Further, the design of the Trident navigation system is less dependent on external navigation aids than were earlier systems.

~~(S)~~ With respect to the GAO recommendations concerning the MC&G support for the Fleet Ballistic Missile Submarine Force, the following comments are provided:

Classified by USDRE.  
Exempt from General Declassification  
Schedule of Executive Order 11652.  
Exemption Category 3.  
Declassify on 31 December 2008.

~~SECRET~~

~~SECRET~~

APPENDIX V

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(U) Recommendation: "...strengthen the policy and operational effectiveness for Naval MC&G support of major weapons systems, such as SSBN's, in order to preclude any deterioration in the U.S. ability to maintain and support strategic defense forces in a high state of readiness."

(S) Comment: The Naval MC&G support to weapons systems should be such as to insure maximum operational effectiveness of the weapons systems. However, this support must be provided as economically and efficiently as possible. Whereas the high risk of OSP due to aging ships is recognized, OSP has to date been able to meet the actual requirement. Steps are also being taken to reduce the operational risk. Steps include activation of newer ships with more dependable operational characteristics, intensified efforts to complete developments that will allow additional survey and backup capability, and new management procedures that provide early indications of problems related to meeting production schedules.

GAO note: The deleted material relates to matters omitted from this final report.

(U) Recommendation: "--assess the vessel capability for the Ocean Survey Program to insure that MC&G data necessary to support the DoD requirements for effective SSBN mission operations can be provided in a timely fashion;"

(S) Comment: The concern expressed by GAO in Navy being unable to continue to support SSBN deployments on time is understandable in view of the fact that over 590 OSP ship survey days have been lost due to unscheduled repairs in the past two years. A review of SSBN priorities and requirements has been conducted by all concerned (appropriate Unified and Specified Commanders, Navy, and DMA), and adjustments have been made to mesh OSP survey plans with planned SSBN deployments. The contribution of satellite derived radar altimetry data and an accelerated gravity processing program developed by the Naval Oceanographic Office enabled a data deficiency, in this case caused by the loss of survey ship time, to be erased.

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(S) The Navy's MC&G program in support of SSBN operations is now on schedule. Various ship and alternate technologies are under review to improve the marginal satisfactory nature of the present program assets. The Navy will continue to review the balance of assets and requirements and will take steps necessary to insure the requirements are met.

GAO note: The deleted material relates to matters omitted from this final report.



~~SECRET~~~~NO FOREIGN DISSEMINATION~~

GAO note: The deleted material relates to matters omitted from this final report.



Gerald P. Dinneen

Principal Deputy

(14201)

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~~SECRET~~

NO FOREIGN DISSEMINATION  
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